Vol. 4. No. 4

April, 1948

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SPE NEWS

Issued Monthly to all Members of the Society of Plastics Engineers

Vol. 4 No. 4 April, 1948

COUMARONE INDENE RESINS

WINNER OF THE $500 FIRST AWARD
FIRST NATIONAL SPE PRIZE PAPER CONTEST

By

CARL E. SNYDER

GLENN L. MARTIN FELLOW

Case Institute of Technology
Cleveland, Ohio

Introduction

It is the purpose of this review to clarify to some extent the chemical nature of the various coumarone indene resins. The review will correlate as much as is possible the physical properties and application of the resins with their chemical structure. Finally, the review will discuss in detail the behavior of coumarone indene resins in GR-S synthetic rubber compounds and offer a theory for this behavior.

Carl E. Snyder

Chemical Nature of Coumarone Indene Resins

Coumarone indene resins or, as they are sometimes called, para coumarone indene resins are prepared commercially from coal tar naphthas produced in the coking of coal in by-product coke ovens. These naphthas distilling between 150° and 200°C contain most of the commercially important resinous producing substances. Originaly these resins included only the heteropolymers of coumarone and indene or, better, mixtures of polycoumarone and polyindene; however, present day usage of the term coumarone indene resins is much less specific. The industry broadly classifies mixtures of the polymers of one or more of the entities appearing in Table I as coumarone indene resins. Polyindene is considered to be common to all the resins but there is reasonable evidence of doubt in the case of polycoumarone.

A hasty glance at Table I shows that the resinous products obtainable can be totally different from a resin produced by polymerizing a napththa containing only coumarone and indene. It is obvious that careful selection and preparation of the naphtha is a matter of great importance. Failure to appreciate this fact is responsible for many of the unsatisfactory products sold as coumarone indene resins and for the variation in their properties. Needless to say this has done much to discredit these resins in the eyes of users in the past.

Coumarone and indene do not polymerize with equal ease. Indene is much the more susceptible to resinification and this effect is quite apparent when the coumarone or indene molecule is alkylated. . Although Stoemer and Boes [1] were successful in preparing a soft polymer of dimethyl indene, they were unable to effect the polymerization of dimethyl coumarone. The resinification of indene proceeds with the evolution of much heat while the resinification reaction of coumarone is only slightly exothermic. It is because of this great difference in case of polymerization that we obtain essentially polyindene when we attempt to resinify a coal tar naphtha known to contain both coumarone and indene. An explana-

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SPE PRIZE PAPER WINNERS ARE ANNOUNCED

National winners of the 1947 Prize Paper Contest were announced today by Henry M. Richardson, Chairman of the Judges Committee and are listed as follows:

First National Award—$500.00
Mr. Carl E. Snyder, Cleveland Section
"Review of Coumarone-Indene Resins."

Second National Award
Mr. D. W. Biklen, Newark Section
"Styling Molded Plastics; Fundamentals, Applications, Benefits."

Third National Award (Tie Award)
Mr. Raymond R. Holman, Detroit Section
"Variables Affecting the Bond Strength of Laminated Plastics."
Mr. N. W. Trepanier, Detroit Section
"Continuous Viscosimeter for the Production Control of Resins and Plastics."

Publication dates for these papers will be announced in the near future.

J. H. DuBois, National President.

NATIONAL SPEAKERS COMMITTEE

The new Chairman of the National Speakers Committee is L. H. Amrine of Imperial Molded Products Corporation. He feels exceptionally elated that two SPE members have agreed to serve with him on this important Committee—Mr. J. O. Reinecke of Barnes and Reinecke, Inc., who was last year's National Speakers Committee Chairman ond Mr. C. C. Henry of Chicago Die Mold Company, Past National President of the SPE and who has done such excellent work on National programs and local programs.

The most important feature of the monthly local meetings is the program. Upon that depends the success of the individual sections.

The National Speakers Committee is anxious to assist the local sections with programs. A list of programs is kept on file by this Committee for the benefit of all local sections.

All program Chairmen of local sections are requested to send in, promptly, their reports on their meetings together with the rating cards on the programs. New cards will be furnished shortly.

It has been suggested that a uniform, planned announcement be gotten up for all sections. This is a topic for discussion and the National Speakers Committee would like to hear from the local sections on this feature.

If programs can be arranged far enough in advance, they should be sent to the SPE News for publication.

PLEASE NOTE OUR NEW ADDRESS:
SPE NATIONAL OFFICE
8905 Lake Avenue
Cleveland 2, Ohio

MEXICO INVITES SPEAKERS

(From a letter to National SPE)

Gentlemen:

Our two meetings to date have been quite interesting, with lectures and a film supplied by our own local talent. However, we would receive most enthusiastically any speaker we could possibly obtain from the States, and arrange our schedule according to his convenience. Any qualified lecturer in the Society who is planning a vacation or business trip to Mexico is most cordially invited to attend our meeting while here, and most urgently requested to favor us with a short talk on his particular topic. All necessary arrangements can be made by contacting me at the address listed below: Plastipos S. A., Apartado 81-BIS Mexico, D. F.

(Signed) W. B. MAY, Jr.

C. W. COE MADE MANAGER

The appointment of Clarence W. Coe as Works Manager was announced by Mr. Frank H. Shaw, President of Shaw Insulator Company. Mr. Coe started his plastics experience in 1915 at the Pittsfield Works of General Electric Company and covered the entire plastics field in subsequent assignments which included all phases of thermosetting and thermoplastic molding extrusion, cold molding and laminating. He is widely recognized for his executive ability and knowledge of molding. Mr. Coe was Works Manager for the Plastics Divisions of the Chemical Department, General Electric Company in Ft. Wayne, Indiana and Decatur, Illinois, prior to his acceptance of the position at Shaw Insulator Company.

Clarence W. Coe

MEXICO GROWTH RAPID

Meetings Bilinqual and Interesting

W. B. MAY, Jr.

From the sixteen plastics engineers and executives who met on January 12th to initiate the Seccion Mexico (SPE News, February Edition), our group has grown to twenty-five members. From the amount of interest shown, there is every indication that by the end of April this number will again have increased considerably.

William B. May, Jr.

After several business and organizational gatherings, we have to date had two meetings with planned programs. The first of these, held on March 1st at the Colegio Nacional de Ingenieros Quimicos y Quimicos, featured a talk by Mr. Fermin Fulda Jr. of the Compania Industrial de Plastics on the subject of Plastics in General. In this he acquainted the gathering with the synthetic resins, the derivations of cellulose, the natural resins, and the many and diversified fields to which plastics may be applied. He then went into greater detail on some of the characteristics and problems of injection molding. This well received talk was followed by the film, "La Era de Plastics" or "This Plastic Age". Both the film and Mr. Fulda's talk were presented in Spanish, which brings up an interesting point. Although it was decided to use Spanish as the official language at our meetings, practically all the Mexican members speak and understand English, and whereas all the "norteamericanos" residing and doing business here are of necessity bilingual, each speaker makes his own choice and either language is acceptable. This way we jockey back and forth in a most interesting fashion. More often that not the Mexicans, anxious to practice their English, will launch a discussion in the foreign tongue.

The second meeting was held on March 18th when we were honored by a most interesting talk given by Mr. Robert Blaine, Technical Service Engineer, International Sales Division of the B. F. Goodrich Chemical Company. Here in Mexico on a business trip, Mr. Blaine had with him samples of the latest developments of his company, many of them not yet on the market. He talked at length on these products, answered many questions, and at the adjournment of the meeting was nearly swamped by the number of interested members crowding around for a closer look at the samples and a chance to ask the questions directly applicable to their own interests.

On the business side in this last meeting, permanent officers were elected to replace the steering committee proposed in the first conference.

(Continued on Page 23)

DETROIT INVITES ENGINEERS TO EXHIBIT

Dear Sir:

This is an invitation to you to lift "iron curtain" of routine thinking on plastics and to see how plastics are being applied in fields other than the automotive.

The occasion will be a thought-provoking evening sponsored by the Detroit Section of the Society of Plastics Engineers. Inc., and best described as **"A New Look at Plastics."**

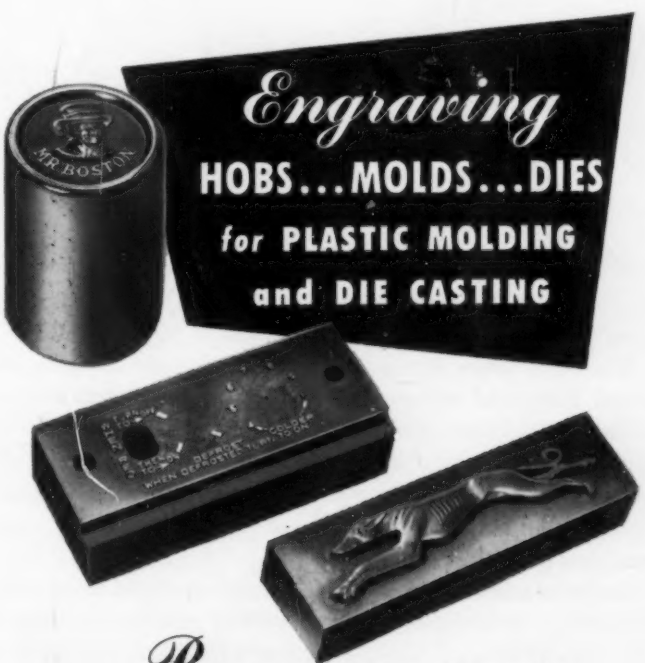
Mr. John M. DeBell, nationally-known consulting engineer on plastics fabricating and manufacturing, will be one of our principal speakers. Dealing with plastics applications seldom encountered in this area, he will provide plenty of stimulation for profitable imagination.

Other aspects of the "New Look" will be the topic of Mr. Charles A. Breskin, publisher and editor of Modern Plastics Magazine. He will present a broad and enlightening survey of the tremendous future the plastics industry holds for all of us.

This program will be given in the ESD Auditorium of the Rackham Memorial Building, May 14, 1948, at 8 P. M.

The Society of Plastics Engineers has planned this event for the enjoyment and benefit of the

(Continued on Page 28)



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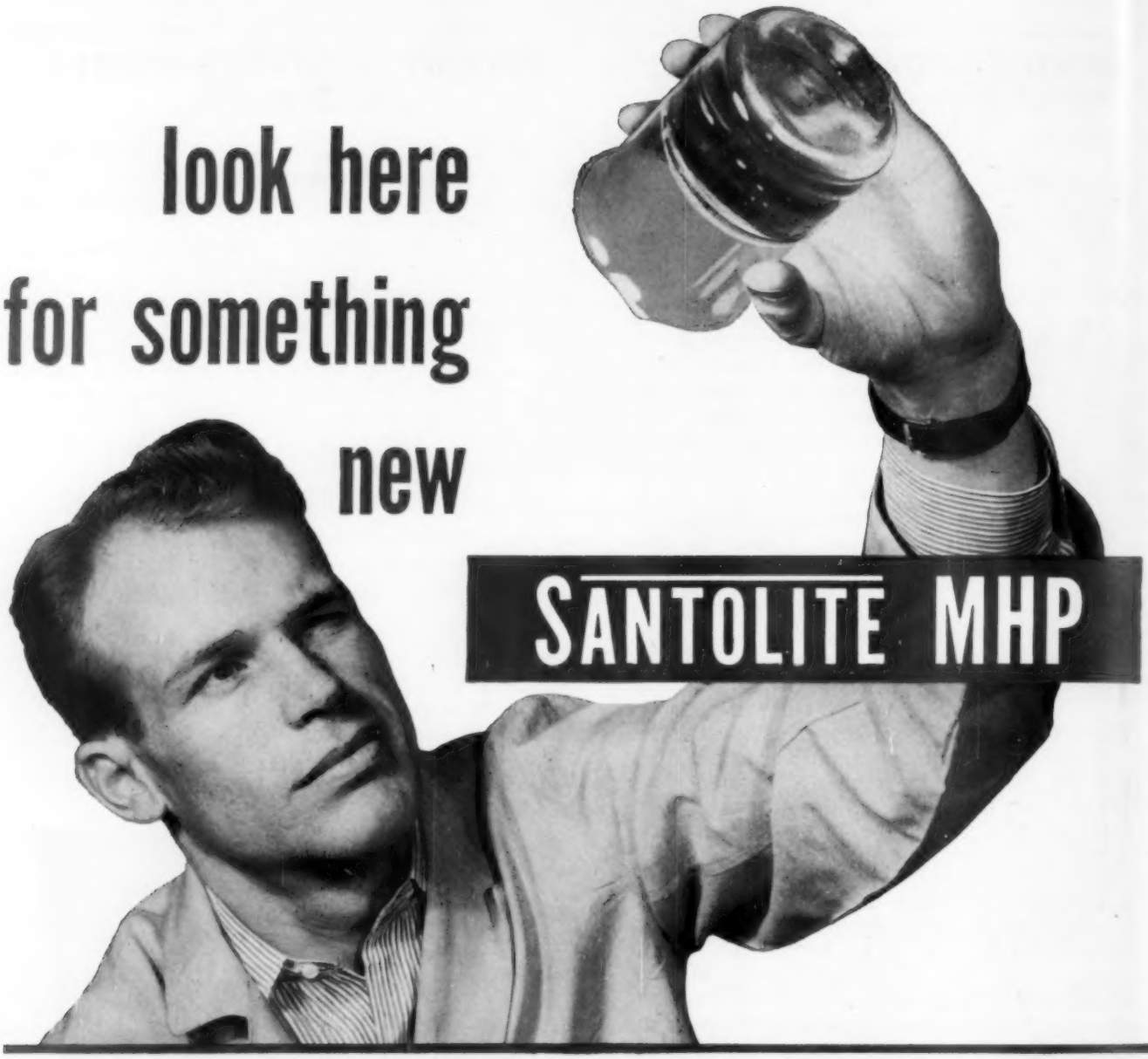

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HISTORY of ST. LOUIS

By E. G. WERNER

with DAN OTTO and ED. RINEHART

During April, 1943 at the suggestion of Ed. Rinehart, a group met at the Kingsway Hotel to consider the formation of a St. Louis Section of the Society of Plastic Engineers. Among those, who attended were:

Robt. Rickenbacker, Monsanto Chemical Co.; Dan Riesert, Lincoln Engineering Co.; Ed. Rinehart, Spaulding Fibre Co.; Chas. Marschner, McDonnell Aircraft Co.; W. P. Donahue, McDonnell Aircraft Co.; Howard Josephson, McDonnell Aircraft Co.; Karl Kopplin, F. Burkhart Mfg. Co.; Ken Erickson, Erickson Hat Die Co.; Roger Shirtum, White-Rodgers Elec. Co.; Geo. Krieger, Spaulding Fibre Co.; Prof. A. W. Brust, Washington University; Al. Gerber, Gerber Plastics Co.

At our first meeting we were much encouraged by Mr. Gaston DuBois, Past President of Monsanto Chemical Company. He pointed out the need of an engineering organization in the Plastic industry. He also stressed the greater value of an individual membership in such a society, rather than a company membership in a trade organization, where the identity of the individual is often lost. That sage advice has been of much help to us, especially during the formative stages.

The Central Council accepted us as a part of the National SPE on February 18th, 1944 and now we have a membership of more than 50.

Following are the presidents, who have lead our section: Edmond S. Rinehart, Howard Josephson, A. G. Werner, C. Todd Clark, and J. Maver Feehan.

During the past three years, valuable services have been given by Prof. Alvin W. Brust of Washington University. He has carried the double load of secretary and treasurer.

Much assistance has been given us by Mr. J. Kenneth Craver of Monsanto Chemical Co. and others of that organization. While their plastics headquarters are located in Masachusetts, their general offices, located here, have cooperated in many ways.

Somewhat prior to the formation of our local S.P.E. Section, meetings were being held by the St. Louis Plastic Club. Among their most active members were: J. Kenneth Craver Monsanto Chemical Co.; C. Todd Clark, F. Burkhart Mfg. Co., Ray E. Lange, Fuel Oil Co. These three men are still among our more active workers.

During 1946 the St. Louis Plastic Club was merged with the St. Louis Section of SPE. That gave us active participation of those who had kept the Plastic Club moving and we all believe that better results have been obtained by combining our efforts.

During the season of 1946-47 we cooperated with Washington University by furnishing and sponsoring the speakers for a night course covering "Practical Plastics." From this course was started a permanent display of plastic parts and materials in the engineering department of Washington University. For this activity much credit must be given to C. Todd Clark, who was chairman and Prof. A. W. Brust, who served as moderator at the sessions.

In the Fall of 1947, Mr. Clark again organized a group of speakers in promoting a night school Forum on Plastics. This was sponsored by The Associated Retailers and the Board of Education. It is very likely that we will again be active in this work during the coming season.

This Forum created much interest among those who purchase and are responsible for the sale of plastic products. Being the only active group we attempt to cover both the technical and trade aspects until such time as more activity in this district will warrant our friends to take over the functions usually performed by a trade group.

Our meetings are held at the Melbourne Hotel on the fourth Tuesday of each month (except July and August.) Any members from other sections are always welcome to be with us while they are in St. Louis. We are adopting a policy to invite non-members of those industries for whom our speakers might have a message of interest and value.

Selections of speakers and subjects are made so as to create interest among the greatest number of our members. A moving picture relating to our industry is often shown to add to the variety of programs. Guest speakers have featured most meetings, but very satisfactory and informative meetings have been had at our Consumers Problem Sessions. Some Sections call them "Gremlin Meetings", but that name does not just seem to fit very well. Somehow, the writer has associated gremlins, (which none has ever seen) with Termites, of which we have seen plenty, but never around any plastic materials, so we consider these little aircraft fellers out of line in plastics. Regardless of what name you call such meetings, we find them a great amount of interest to a large segment of our membership.

Right here we want to give a vote of thanks to a number of members from various sections, who have given of their time to appear on our programs. Thanks, fellows.

One or two meetings are set aside annually for speakers not connected with our industry. We have sought a speaker for such occasions who could combine a bit of humor with an inspirational message. This adds spice to our programs and we believe that most of us get so close to our own work at times that we fail to see the forest on account of the trees.

(Continued on Page 8)

Front row left to right: W. M. Klaile, President, Technical Societies Council of New Jersey; James Growley, President, Newark Chapter, Society of Plastics Engineers; Dr. W. J. Sparks, Director Esso Laboratories, Standard Oil Development Co.; A. J. Warner, Federal Telecommunication Laboratories; Professor I. D. Gerard, Professor of Chemistry, Rutgers University; R. Burns, Bell Telephone Labs and Chairman A.S.T.M. Committee D-20 on Plastics.

Standing left to right: G. W. Nigh, Tidewater Associated Oil, and Chairman, New Jersey Div. American Society of Mechanical Engineers; T. Smith Taylor, U. S. Testing Laboratories; A. Nufer, President, New York Section of Society of Plastics Engineers; J. H. DuBois, National President, Society of Plastics Engineers; M. Parke Davis, Otis Elevator Company and Chairman, New York District Council of A.S.T.M.; Russ Aiken, Research Dept., Du Pont Company, Plastics Div.; R. H. Bell, Lucius Pitkin Co., Inc. and Chairman of Society for Applied Spectroscopy; Carl Frosch, Bell Telephone Laboratories.

FUTURE OF SYNTHETIC CHEMICALS DISCUSSED AT NEWARK SECTION

By HAROLD SCHOR

Synthetic gasoline and other liquid fuels, manufactured from natural gas or coal, is a development anticipated in the near future, from synthetic chemicals research. Such trends, concerning not only fuels but also the whole field of synthetic chemicals, were forecast by Dr. W. J. Sparks, Director of the Chemical Division of the Esso Laboratories of the Standard Oil Development Company, at the March meeting of the Newark Section held at the Newark Athletic Club.

According to Dr. Sparks, there are four major trends which are expected to influence future synthetic chemistry. These are:

1. In the development of synthetic chemicals detailed chemical and physical properties—concerning both purity and performance — have become increasingly important.

2. Applied synthesis will develop during the next few years from technical knowledge already available; for example, atomic fission which arrived very suddenly in public consciousness, was based on knowledge accumulated over a period of the preceding fifty years.

Harold Schor

3. Use of petroleum for manufacture of synthetic organic chemicals has increased from zero to almost 50% during the past 20 years. It is expected that petroleum will continue to become increasingly important as a raw material basis for chemical synthesis.

4. Developments outside the strictly chemical field are likely to play a predominant role both in availability of raw materials and actual chemical synthesis processes. One example of this, known as "hydrocarbon synthesis", is the anticipated manufacture of liquid fuels from natural gas or coal. Any major development in synthetic fuel manufacture would lead to production of simple organic chemical compounds in quantities which are exceedingly large in comparison with present-day consumption of these products.

Dr. Sparks answered many questions concerning chemicals of interest to the plastics industry. Among other things he forecast that there will be increasing supplies of established plasitcizers and many new plasticizers produced from research in petroleum chemistry.

Following the program, a short business meeting was held. Jim Grawley, section president, urged that meeting programs be strengthened during next season. To implement this, Gilber L. Peakes, who is with Bakelite, and a member of the Newark section board of directors, was appointed program committee chairman.

It was agreed that there would be more than one speaker at each meeting, and that the subjects should cover the diversified interests of all the members. To carry out this idea, a committee was appointed to assist Mr. Peakes—one that would be representative of all these interests. The committee includes:

Edward Rowan, Dillon and Beck Mfg. Co.—representing the injection molders.

J. H. DuBois, Shaw Insulator Co.—representing the compression and transfer molders.

Russ Akin, du Pont—covering thermoplastic materials.

R. Frackenpohl, Newark Die Co.—representing the toolmakers.

Gil Peakes. in addition to being chairman, would cover the thermosetting materials.

It was felt that such a strong committee was a guarantee of interesting and varied programs for the 1948-1949 season.

The meeting aroused such widespread interest that representatives of other local technical societies attended. These included:

Dr. I. D. Gerard, Professor of Chemistry, New Jersey College for Women, Rutgers University, and Chairman North Jersey Section of the American Chemical Society.

W. M. Klaile, President of Wm. Klaile Machine Shop, President, Technical Societies Council of New Jersey and Chairman American Society for Metals, New Jersey Chapter.

R. Burns, Bell Telephone Labs., Chairman of A.S.T.M. Committee D-20 on Plastics.

M. Parke Davis, Otis Elevator Company, Chairman A.S.T.M. Committee D.-20 and Chairman, New York District Council of A.S.T.M.

G. W. Nigh, Tidewater Associated Oil, Bayonne, N. J. Treasurer, Technical Societies Council of New Jersey and Chairman, American Society of Mechanical Engineers, Metropolitan Section, New Jersey Division.

Dr. R. H. Bell, Lucius Pitkin Co., Inc., New York City, and Chairman of Society for Applied Spectroscopy.

A. Nufer, Chairman, New York Section of S.P.E.

At the April meeting, Newark will be host to the New York Section. Scheduled on the program are: Mario Petretti· Noma Electric Company, speaking on large multiple-cavity compression molding; and Wes Larsen, of DeBell and Richardson, Springfield, Mass., on small-run compression molding.

NEED MAN IN INDIA?

S. M. Patel, 141 W. Main St., Newark, Delaware, Chemical-Physicist Graduate (Bombay U., India). One year Advance Plastics Technology at Plastics Industrial Technical Institute, Los Angeles, M. S. in Polymer Chemistry at Delaware University, due in May 1948. Member of the Society of Plastics Engineers and Plastics Institute, London. Business experience, speak several Indian languages, foreign expreience. Wish

(Continued on Page 28)

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Klippings from Kozy

By WALTER KOSY

Popular Charles Hamilton, one time Kurz Kasch representative in Detroit and ex-president of the Detroit Chapter of SPE, has been appointed District Sales Manager for Kurz Kasch in a new sales territory comprising Western New York State, Western Pennsylvania, and Northeastern Ohio, with headquarters in the News-Herald Building, Franklin, Pennsylvania. Best of luck to you, Charley.

Walter Kosy

Our hard working Dr. C. W. Selheimer did such a swell job for the American Institute of Chemical Engineers when they held their national convention in Detroit last fall that he has been appointed Chairman of the National Convention of the Division of Rubber Chemistry of the American Chemical Society when it meets in Detroit next November.

Fourteen year old Edgar Gress, son of George Gress, one of the charter members of the SPE. believes in an early start. He has organized Edgar Gress Associates, and is doing a thriving business in plastic lamp shades, flower pots, and clothespins, through a deal with Roger Plastic Company in Massachusetts. Just a chip off the old block, we would say.

Ex-president Walter Noble's recent visit to Kingsport, Tennessee, was made by slow freight. He's allergic to the airlines. "I know there isn't much you can do when your number's up," says Walt, "but I just hate to be on one of those damn planes when the pilot's number is up!"

Congratulations are in order to Fred Schwab of Schwab and Frank, Incorporated, who recently became the father of a bouncing baby boy. Says Fred, "Here's one baby that was born with a PLASTIC spoon in his mouth."

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DESIGN CONTEST ANNOUNCED

The Gage Publishing Company, New York, announces the Tenth Annual Electrical Manufacturing Product Design Awards, five cash purses totaling $2500 being offered for the most interesting and realistic accounts of product development.

The competition is sponsored by the publishers to stimulate and encourage those engaged in the design and development of electrically operated products and to accord appropriate recognition for outstanding achievement. A certificate of award will also be presented to successful contestants.

Entries are now being accepted and the closing date for the filing of manuscripts is June 30, 1948. The results of the Competition will be announced in the Tenth Annual October Product Design Number of Electrical Manufacturing where the Award Manuscripts will be featured.

REVERI AT PLASTICS PROD.

Mr. Ralph F. Chambers of Plastics Productions, Inc., 1602 Pauger St., New Orleans, Louisiana announces that **Mr. Erwin Reveri** has joined his organization as Production Superintendent. Plastics Productions, Inc. is well known as the largest fabricator of acrylic plastics along the Gulf Coast. They are especially active in the acrylic plastic signs and architectural applications.

Mr. Reveri comes to Plastics Productios, Inc. from his own plant, Dual Fabricators Corp. of New York City. During the past fourteen years he has been recognized as one of the leading designers and production fabricators of displays in plastic in New York City.

History of St. Louis *(From Page 5)*

The St. Louis district is usually considered a limited field for plastics, but the classified ads in the telephone directory show 70 different listings. Twenty years ago not one name was classified because at that time there just was no such animal known as plastics. This is good evidence that we are taking our place in the rapid strides that are being made everywhere by our industry, that so much needs the assistance and fellowship of S.P.E.

We are one of the average size sections, that constitute the majority in numbers of our 30 sections. Much help has been given in the past by the larger sections to those of limited numbers and such cooperation can often be made of material value to those who give such assistance. It is only fair that such help should be acknowledged in open meeting to the limited, but selective group of members, who often are prospects for those who give their time for talks, etc.

It is only by working together that SPE can remain a worthwhile institution and we in the St. Louis Section are striving to help the Plastic industry in the same grand way that it has helped so many others.

TAKE YOUR CHOICE

By CHARLES LICHTENBERG
Assistant General Manager of Sales, Plastic Div.,
Monsanto Chemical Company

THOUGH GEORGE SMITH, plastics molder, may not realize it, Jose Martinez, adobe brickmaker, and Chang Lee, tortoise shell artisan, know a lot about Smith's problems. They had them, too, and so did their forebears.

Like Jose's adobe brick or Chang's exquisite tortoise shell cigarette cases, Smith's plastic applications from combs to grinding wheels depend on the best material for the use, practical design, and sound production technique. Without these the customer looks the other way.

With dozens of plastics and hundreds of plasticizers available, it is more than ever our responsibility to choose the right combination of materials, molds and techniques for a particular job. Misapplications, which do the industry a real harm, are inexcusable. This article, which points the dangers and the remedy, is reprinted from the plastics issue of Monsanto Magazine, published by Monsanto Chemical Company.

Jose, sunbaked like his bricks, begins with a choice, finely particled heavy-textured clay. With Chang, the glint in his eyes lights up when he fingers the gold and brown mottled armorplate of the hawkbill turtle that suns himself off the eastern coast of the Celebes. For both, a material of lower grade means less than top quality products, and perhaps expensive misapplication.

So it is with Smith. His problems starts with a choice. Which plastic will do the job? Later on he will have other choices, too, but the selection of the material comes first.

Smith has had to learn his plastics three R's in twenty years or less, where Jose and Chang have had hundreds, but learn them he must. That a few of Smith's thousands of brother molders have not always absorbed these lessons, and have leaped into misapplications has been a painful fact of the industry's adolescence. There are

(Continued on Page 10)

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Take Your Choice (Continued from Page 9)

many today who remember the tea strainer that sagged out of shape like a wool sweater when doused in hot water. Or a plastic spoon that curled up in the soup. But for the most part application skill has replaced the get-in-and-make-all-you-can-and-get-out psychology of one school and the ignorance and costly trial-and-error of another school. The industry — fabricators, molders and raw materials producers — and the public are seeing to that. Even during the period when faulty use of plastics was at its most exasperating level, never a very high one, American manufacturing was finding thousands of right jobs for plastics for every one that was wrong. Indeed, plastics invaded many a realm because plastics alone could do the task required.

Electronics, for instance, could never have realized its present stature if it had only ceramics for vital insulation. Phenol, urea and melamine formaldehydes, and styrene-based plastics kept pace with the physicists' drawing board where ceramics could not. Nor could the Shooting Star jet plane have its battery without injection molded polystyrene; rubber and metals just couldn't take it. Plastic gears and wheels and bearings by the score have replaced metals in machine after machine. They wear longer, lubricate more easily and stand impacts more readily than the metals that once had the job.

Here and there, however, there still persists the impression that plastics have not lived up to their billing. To a large degree, this thinking derives from a belief that plastics should be miracle test-tube materials and in practice they are not. A plastic dish breaks, it is said. What china cup has not done so more readily? Or a plastic drinking glass breaks when Junior steps on it. Would you step on glass? But in each case plastics have features that former materials do not have, — the dish and glass are lighter, are colored throughout, don't chip, make less clatter. Public misapprehensions regarding plastics materials mistakenly suppose that plastics have all the desirable properties of any other matrial but **none** of their faults.

Real objections that prick the ear of the industry and bring quick reaction are reports from the public of this type: an ash tray is made of cellulose acetate which will carry telltale burn marks when it should have been made of scar-resistant phenol formaldehyde; or an inexperienced entrant into the field is merchandising a raincoat with a sticky polyvinyl chloride film when the correct polyvinyl chloride formula would bring praise.

Plastics is no business for the novice, as many have learned. With twenty-three basic different plastics, dozens of fillers, scores of solvents, a dozen different fabricating and molding methods and hundreds of plasticizers, plastics manufacturing requires special knowledge, just as it does to operate an automobile plant or a steel foundry. Most encouraging portent for the continued robust health of this industry is the fact that these facts have spread widely. The one machine in the back of the garage of twenty years ago has given way to the plant with a dozen or a hundred machines in spacious buildings, with a competent engineering staff, a reputation for quality, and respect for the fact that the buyer has a longer memory than the elephant.

When the modern molder or fabricator of plastics approaches his problems of manufacture, he does so gingerly and with a sheaf of facts. First he defines the end use requirements he must meet. Let's presume the housing of a vacuum cleaner holds the stage.

He has reports from Mrs. John Citizen that her metal-housed vacuum cleaner is too heavy, paint chips off, the color is drab, and sharp corners mar her furniture. Plastics, instead of light metals or steel of thinner gauge will, he believes, provide the answer.

His engineers have reported that the application is feasible, providing it will stand heat of radiators, will not crack upon hitting, will not warp, will resist cleaning chemicals, is not inflammable, and has electrical resistance. He rejects polystyrene (too difficult to injection mold

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and brittle for this use, but fine for thousands of others); he likewise pigeonholes cellulose acetate (may warp, absorbs moisture). He could consider others but his knowledge leads him presently the phenol formaldehyde. Actually he could dream of the ideal material, one that would never break and wear forever. But he knows that any he may select will have some imperfections. So he picks his most nearly ideal material.

At this point he comes cheek-to-jowl with problems of cost. Material cost is reasonable, although not quite as low as steel on a volume for volume basis. But he will need fewer pounds per unit, and what is more important, his number of steps in manufacturing and finishing are fewer and less time-consuming, hence less costly on a product basis.

Compression molding seems the best. The mold may push up overhead total by $7,000 to $8,000. However, if 100,000 housings or more are needed that means only seven or eight cents per housing. Add to these costs labor, engineering, shipping (he saves considerable here in comparison to heavy metals), and the whole job seems practical. Furthermore, Mrs. Citizen will get more streamlining, color styling, will not have paint to chip or sharp corners to scratch. She could easily lift it and finish a whole house fresher than she would be if she'd pushed a heavier mechanism just around the living and dining rooms. From the manufacturer's standpoint, he'll have less parts to assemble, no finish to apply, will thus pare costs.

Everything about the phenolic vacuum cleaner housing sounds ideal, but remember this is no field for a novice. There's many a corner to pass before that attractive new product can roll down the finishing line. Design causes the most brow-furrowing. No sharp corners can be allowed, the plastic will not flow smoothly into all remote sections of the mold. Some strengthening or ribbing in areas where likelihood or cracking is greatest may also be called for. What filler to order in the plastic? Wood flour costs least and molds easiest but is less strong than fibers.

These and other questions present themselves to the designer. He must pore over material specifications, results of the American Society for Testing Materials (ASTM) to find his proper balance of physical and chemical properties. He probably confers with the manufacturer of his molding powder several times before he sends his blueprints to the mold builders.* Mold makers will take twelve weeks, — three months of drilling, grinding, boring, chromium plating and polishing before the molder can put his waiting compression molding machine (priced up to $10,000) into operation.

Then he checks and re-checks molding cycles—35 seconds, 45, 50, 60—and adjusts electronic preheating schedules. Finally, he's ready to go six months after the vacuum cleaner maker starts the wheels moving. Yes, risks, pitfalls and a heavy investment of time and capital go into the housing before Mrs. Citizen can see her first vacuum cleaner plastic housing in a window, and say, "That's just what I've been looking for, I wonder why they've waited so long."

With each application the molder can slight no step in planning and production. He gambles too much if he does. Yet many an otherwise cautious entrepreneur has wanted to get into plastics, believing he could do it in the back part of the shop and realize quick profits. Thankfully most of the ill-advised gived up this dream after their first conversation with a competent molder or designer. Others go farther, only to lose their wallets before they have put out a product. A few of the strongest and most persistent complete the obstacle course.

Even long-established molders sometimes find an end product doesn't meet their expected specifications, in spite of their painstaking preliminary calculations. This probably occurs because applied plastics sometimes have different end properties than the uniform test specimens. Polystyrene, for instance, may have actually gained higher heat resistant properties, or cellulose acetate may lose tensile strength in the molding when molecular chains of the resin do not line up properly. Never, if he can avoid it will a rep-

(Continued on Page 12)

NOTE—An average molder with twenty compression machines would have $300,000 to $500,000 tied up in molds alone.

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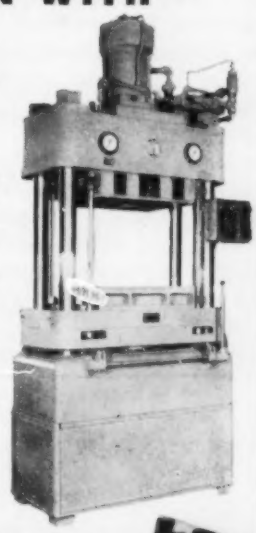

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(Continued from Page 11)

utable molder allow such a product to reach the market.

He checks again, makes changes in his mold, alters his heating cycle, in cooperation with his material supplier he adjusts formulation. When has the bugs worked out, and only then, will he put his product in the showcases of stores. As the chemists' bank of knowelge about the inherent qualities of his building blocks grows larger these misfires occur less frequently. And as all leading molders and raw material manufacturers regard the temperature of public opinion as conscientiously as a doctor does with his patient's blood pressure, misapplications have little chance of ever reaching the market. Furthermore, the buyer sees ever more frequently clear instructions and sensible labelling on the plastics products he buys, to the end that he will not use a non-boilable plastic to stir the stew or assume that a waterproof, stainproof upholstery will also stand mistreatment from a cigarette.

Though smaller makers of plastics products can't afford to keep testing physics, research chemists and design engineers on their smaller budgets, they are securing the expert talent and advice they want. Businessmen, like the vacuum cleaner manufacturer, who wants a housing or the merchandiser who wants a distinctive plastic lampshade can depend on the skilled advice of the experienced molder. The small molder on the other hand can go to expert consultants or to material manufacturers. Monsanto, for instance always staffed with numerous experts in every major field, two years ago formalized some of its advisory service operations in its Technical Service Council, a group of ten whose experience brackets the variegated industry. This service has obviated an unnecessary rush for the aspirin bottle, and has steered numerous aspirants to plastics into the right plastic and production method for the job. Frankly approaching each request, be it a toy, a greeting card recording or a sand dome for a locomotive, the practicality of the application is carefully analyzed, and the advice-seeker is directed to the proper material, though it may not be one of the eleven basic plastics which Monsanto makes, or may not be plastic at all.

Into whatever corner of the industry you look, one sees massive evidence that the industry has matured tremendously since the early war years. From the billions of pounds of plastics products, the hundreds of thousands of applications for war and peace plastics people have telescoped decades of experience.

No lesson of this crammed storehouse of learning has emerged more clearly than this: Choose the right plastic, the right design, the right production method. And putting this chapter to work, the industry takes its choice, and it makes them right.

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MIAMI VALLEY SECTION

By JOHN L. RUSSELL

A joint dinner meeting with the American Society of Tool Engineers, A.S.T.E. was enjoyed by members of Miami Valley Section on March 8 at the Engineers Club.

The speaker was Mr. Earle Johnson Sales Engineer of the Rockford Machine Tool Co., manufacturers of the Rockford Hy-Jector Molding machine. Mr. Johnson showed a film and lectured on injection molding of thermosetting plastics.

On February 5, Miami Valley Section members from Dayton and Cincinnati met for a plant tour of the Plastic Moldings Corp., 859 Hathaway St., Cincinnati, Ohio. This firm molds thermosetting plastic parts. About 58 members and guests were in attendance. Mr. J. E. Baxter of Cincinnati was the chairman arranging the event.

Mr. Robert W. Gerdes, Sales-Manager of Plastic Moldings Corp. and Vice-chairman of the Program Committee led a discussion on future programming, after which a lively discussion from the floor resulted.

The Dayton members chartered a bus for the trip and had a very enjoyable time. Refreshments were served at the close of the meeting. Mr. Ed. Gerdes, President of Plastic Moldings Corp. and his plant personnel are to be congratulated for their hospitality.

President G. J. Wilson has announced the following appointments:

National Director, H. J. Kasch, Jr.; Program Chairman, W. F. Oelman; Membershop Committee Chairman, J. G. Braden; Chairman Professional Activities, F. E. Schneider; Chairman Publicity Committee, C. M. Jensen, and SPE News Reporter J. L. Russell.

Mr. Braden is planning an intensive campaign to acquaint prospective members with the advantages of affiliation with S.P.E.

PLASTICS MAGAZINE has been sold by the Ziff-Davis Publishing Co. to Vincent Edward & Co., trade journal publishers of Boston and New York. The address for editorial material is now: Plastics, c/o Vincent Edward & Co., 342 Madison Ave., New York, N. Y.

G. P. HUMPHREY has moved his sales and purchasing offices from the Chatham-Phoenix Bldg., Long Island City, to new quarters in the Esquire Bldg., 366 Madison Ave., New York 17, N. Y. The new phone is Vanderbilt 6-3417.

BUFFALO TAKES SPACE IN PROGRESS EXPOSITION

By J. CLARKE CASSIDY, Jr.

Jim Cox and his Program Committee came up with an oustanding program at the February 27 meeting which was attended by 32 members and guests. New members introduced by the Membership Committee included John P. Brecker of Rathbun Molding Corp., Ralph H. Rushmer of The Carborundum Company, and Kent Alverson of Spaulding Fibre Co., Inc. Treasurer Hi Nathan reported that the Buffalo Section was still highly solvent financially. A discussion was held concerning SPE participation in the Buffalo Industrial Progress Exposition — more on this below.

Trimold, Inc., had on display in the meeting room a most interesting selection of injection molded parts now in production at their plant. Dick Van Geem of Trimold

gave a brief history of the company and described a few of the interesting applications. He then introduced Mr. Kenneth Carlson of Frederick Flader, Inc. Mr. Carlson described in detail the development by his company of a new aircraft antenna system made possible by molded polyethylene parts supplied by Trimold. It is expected that the new system will be of extreme importance in reducing the number of airline crashes by doing away with corona discharge from the antenna system. This phenomenon has been definitely established as a contributing factor in a number of airline and military aircraft disasters.

Jim Cox next introduced Mr. Earl Johnson, Assistant Sales Manager of Rockford Machine Tool Company, featured speaker of the evening. Mr. Johnson was accompanied to the meeting by Paul A. Abell and Frank J. Morris of Walter F. Rogers & Company who represent Rockford in the Western New York area. A color movie of the Rockford "Hyjector" was first shown, after which Mr. Johnson answered many questions from the floor.

The main topic of discussion at the March directors' meeting was SPE participation in the Buffalo Industrial Progress Exposition. It was finally decided that the most practical method of assuring adequate representation of the plastics industry in the Exposition is for SPE to have their own space staffed by SPE members and including a small representative exhibit of plastic products manufactured in the area and literature from local companies. A committee was appointed to investigate and take appropriate action.

PERSONALS

LLOYD T. MOORE, Manager of Applied Plastics (Div. of Keystone Brass Works — Erie, Penna.) has found effective medicine for the rugged conversion from Winter to Spring in Erie, Penna. He is basking it out in New Orleans to the envy of the other members of N. W. Penna. Section.

PAUL C. ROCHE, Nosco Plastics, Erie, Penna., has just obtained certification as a registered engineer in The Commonwealth of Penna. Many of the other SPE members of N. W. Penna. Section have applied, whose registrations are expected to be passed in the near future.

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SECTION NOTES

THE SOUTH TEXAS SECTION of S.P.E., which is a member of the Engineer's Council of Houston, announces that there will be an Atomic Energy Symposium at the Rice Hotel, Saturday afternoon and evening, May 1, 1948. Important papers will be presented on the power, industrial and biological applications of atomic energy. Mr. Summer T. Pike, Vice Chairman, U. S. Atomic Energy Commission, will present the featured paper, "Economic Aspects of Atomic Energy", at the evening banquet. Anyone interested contact Mr. Harold Decker, 12th Floor, Mellie Esperson Bldg., Houston 2, Texas.

THE CHICAGO SECTION enjoyed Mr. Paul Fortner's talk on Extrusion at their April 6th cocktail and dinner meeting in the Merchants and Manufacturers Club, Merchandise Mart. Mr. Fortner is in the Plastics Division of E. I. Du Pont de Nemours.

THE NORTHERN INDIANA SECTION held their April meeting on the 6th in the G. E. Squares Hall, 219 E. Berry Street, Fort Wayne, Indiana.

THE WESTERN NEW ENGLAND SECTION heard Mr. Ralph E. Hammer, Plastics Laboratory, General Electric Co., Pittsfield Mass., speak on "Protective and Decorative Coatings for Molded Plastics." The dinner meeting was held April 7th in the Hotel Sheraton in Springfield. There were door prizes presented.

THE NEW ORLEANS SECTION received front page notice of their March 4th meeting, which is written up elsewhere, in the paper "Action" which is the official publication of the Young Men's Business Club of New Orleans. A new section that is growing fast.

THE ROCKY MOUNTAIN SECTION listened to Mr. E. K. McQuary, Executive Director of the Governor's Council for Resources Development, discuss the work of the council and how that area may best benefit from the development in the plastics field. The meeting was held at the Navarre Cafe on March 17th.

ST. LOUIS has found smoker meetings to be popular. Mr. Peter Yesikenas of Monsanto spoke on plastisizers and protective coatings March 23rd at the Melbourne Hotel.

N. W. PENNSYLVANIA found Islyn Thomas, well-known author of "Injection Molding of Plastics" to be interesting at their March 11th meeting at Zukors Club. Thomas spoke on "Injection Mold Design."

ST. LOUIS will meet April 27th at the Melbourne Hotel to hear a double-header. Karl Kopplin, President of the Kopplin Molding Co. will speak on High Pressure Molding Methods. Charles F. Marschner of the McDonnell Aircraft Corp., will speak on Low Pressure Molding Laminates.

SOUTH TEXAS SECTION met at the Ben Milam Hotel in Houston on March 17th to hear Mr. D. R. Williams of the Dow Chemical Co., speak on Thermop'astic Extrusion. The lecture was slide illustrated giving the manufacturing steps required for proper extrusion of thermoplastics in general. Exhibits were by Naltex, Inc.; Modern Products; Dow Chemical Co.; Cary Products, Inc., and Nichols Industries. At this meeting the section charter was presented to the section president Dan E. Bloxsom.

Committees appointed were: Membership, Harvey, Sinclair and Collins; Election—Nominating, Harrison, Henrich and Barnes; House—Publicity, Barnes, Wallin and McFayden; Program, Clarke, D. E. Henderson and Harvey.

Next meeting of the South Texas Section is set for May 19th at the Ben Milam Hotel in Houston.

ROCHESTER met March 16th to hear C. Norman Wade of the National Vulcanized Fibre Co. speak on "Vulcanized Fibre, Its Manufacture and Applications". Mr. R. Sultzbach's SPE prize-winning paper "Plastics in the XY System" was presented, with effective slides for illustration. Sultzbach is with the Stromberg-Carlson Co. Thumbnail sketches were given by members Murray E. Barkley, George H. Britton and Eugene C. Cathcart.

ROCHESTER met jointly with the Industrial Management Council of Rochester on April 5th to hear Chicago member Jean O. Reinecke, executive vice-president of Barnes and Reinecke talk on "Industrial Design."

ENESPE (Eastern New England Section SPE) turned out to hear G. V. Sammet Jr., Production Manager of the Northern Industrial Chemical Co. talk on "Reorganizing Your Plant". The meeting was held at the Hotel Puritan on March 25th.

PERSONALITIES

JERRY C. STOKES, President of the Perry Plastics, Inc. of Erie, Penna. announces the combining of interests of that company with certain of the interests of Acorn Plastics Engineers, Inc. of Erie, Penna. The facilities of "Acorn" will now be a part of Perry, all manufactuing operations having been consolidated at the Acorn plant. Acorn will continue as a sales organization, of which Robert Ely continues as President, besides acting as an official of Perry Plastics.

JAMES P. QUINN, President of Quinn Berry Corp., Erie, Penna. has earned the praise of The Northwestern Pennsylvania Section for the success of his venture as March meeting sponsor for the section. Attendance, which was less than 20 at the previous meeting, exceeded 60 at this meeting. Also responsible for this success was energetic action on the part of all section committees.

J. ALBERT LORANGER and ROBERT WILSON, both of Sylvania Electric Products, Inc., Warren Penn., will be co-sponsors of the April meeting of the Northwestern Pennsylvania Section to be held at Warren. The success of their handling of a Spring meeting in 1947 gives assurance of live-wire sponsorship of the April meeting.

The PRODUCTION ECONOMICS of PRESS DESIGN

By HENRY M. RICHARDSON
of DeBell & Richardson

Presented at the 1948 SPE National Conference

As molding materials are becoming more plentiful and as supply and demand in the field of both molding compounds and molded parts are coming into balance, we approach a period of intense competition in the plastics molding industry. This competition is not only among the molders, but also between plastic molded articles, compared to articles for the same uses made of wood, metal, glass, ceramics, or other materials. It is timely, therefore, that we should take a careful look at the anatomy of the cost of molding plastic parts and examine carefully the things which can be done in order to decrease cost, increase production, and thereby retain the business and make a profit.

We can assume that the cost and quality of the molding material is substantially the same for all molders who compete for a given piece of business. The molder must, therefore, rely on what he can do with the cost and efficiency of conversion of this compound into molded parts. In a general way, the following are the things which the molder has to work on:

1. Designing of the molded part for efficient use of material and easy molding.
2. Design of the mold for maximum output, minimum flash or cull waste, continuity of production and minimum maintenance liability.
3. Efficient use of the operator's time and effort. Operator time and motion should only be used on those operations which cannot be economically made automatic.
4. To provide equipment; presses, preheaters, fixtures, material and parts handling which will allow maximum quantity in pounds per day per press to be produced. Also, flexibility can be built into the press operation which allows higher "percent utilization" of equiment.
5. Appropriate and efficient methods of flash or gate removal, finishing and special operations on the molded parts.
6. Good business management which provides the other manufacturing functions such as supervision; quality control; materials procurement, storage, preparation, and handling; personnel relations; production scheduling; inspection, packing and shipping; clerical and accounting services; and advertising and sales.

It is the purpose of this paper to consider only a small part of the above subject; only the characteristics of molding presses for compression and transfer molding of thermosetting plastics as they affect the cost and efficiency of conversion of molding compound into molded parts. For this discussion, let us confine ourselves to the cost of molded parts as they leave the press-room. On this basis, let us set up an example with arbitrary rates and conditions which can be changed to suit individual actual conditions for any particular case.

The ruling elements of cost which we are using in our example are as follows:

1. Direct material at $.18 per pound, pilled.
2. Direct labor at $1.15 per hour (24 hours) for production of 70% of theoretical possible cycles of a given length. Also for comparison, a direct piece-rate incentive which raises the direct labor from $1.15 per hour to $1.48 per hour for production of 90% of theoretical possible cycles of a given length.

(Continued on Page 16)

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Economics (Continued from Page 15)

3. Press-hour overhead (24 hours per day) includes supervision, power, heat light, services, and general overhead. $1.25 per press-hour.
4. Investment cost (press only) we will assume to be $10,000 per press (150-ton) with 10 year amortization, 4% interest on unamortized balance; and 3.5% taxes and insurance on initial investment. Assuming utilization of 42000 hours per year, gives $.373 per hour per press.
5. Waste and spoilage: assume 93% yield in pounds of parts from pounds of compound and that 2% of the parts are rejected for molding faults.

With these elements assumed, we may determine the cost per press cycle as a function of cycle length, and the conversion cost per pound of parts delivered from the press-room.

The cost of conversion per cycle without material, using the above assumptions is shown in the following tables for a 60-second standard cycle and with efficiency of 70% (42 cycles per hour) and 90% (54 cycles per hour) and with 2% spoilage in each case.

TABLE A

Cost of Single Cycle at Base Rate, 70% Efficiency, and Per Minute of Cycle Time (42 out of possible 60 per hour).

1 operator per press	$\frac{1.25 + 1.15 + .373}{(.98 \times 42)}$	= $.0675
½ operator per press	$\frac{1.25 + 1.15 + .373}{2 \quad (.98 \times 42)}$	= $.0534
No operator	$\frac{1.25 + 0 + .373}{(.98 \times 42)}$	= $.0396
Equipment Cost	$\frac{.373}{(.98 \times 42)}$	= $.0090

TABLE B

Cost Per Cycle at 90% operator efficiency ($1.48 average hourly take-home on $1.15 base rate) and Per Minute of Cycle Time (54 out of possible 60 per hour).

1 operator per press	$\frac{1.25 + 1.48 + .373}{(.98 \times 54)}$	= $.0587
½ operator per press	$\frac{1.25 + 1.48 + .373}{2 \quad (.98 \times 54)}$	= $.0449
No operator	$\frac{1.25 + 0 + .373}{(.98 \times 54)}$	= $.0307
Equipment Cost	$\frac{.373}{(.98 \times 54)}$	= $.0070

Let us now add the cost of the material and consider the effect of unit molding pressure in a given size press on the cost of conversion of compound into parts. A 150-ton prees at 4000 psi will accommodate a parting line area of 75 sq. in. At 8000 psi this will only be 37.5 sq. in. In either case, for the purpose of this discussion, we will assume an average thickness over the parting line area of ¼". This will give a compound charge of 15 oz. at 4000 psi, but only 7½ oz. at 8000 psi. If we further assume the case of a high speed transfer plunger mold and that the net weight of parts is 93% of the compound charge, and include spoilage of 2% the average output per cycle of molded parts will be .855 lbs. at 4000 psi and .427 lbs. at 8000 psi. With compound at $.18 per pound, pilled, the 93% yield per charge and 2% spoilage bring the compound cost per pound of saleable molded parts up to $.19¾ per pound.

Using this value for material cost and the conversion cost per cycle, we can set up a comparison of cost per pound of molded parts as follows:

TABLE C

	4000 psi		8000 psi	
	70% eff.	90% eff.	70% eff.	90% eff.
60-Second Cycle				
Pounds/day	862	1109	431	554
Cost/Pound (1 opr.)	$.277	$.266	$.355	$.335
Cost/Pound (½ opr.)	$.260	$.250	$.322	$.303
50-Second Cycle				
Pounds/day	1032	1330	516	665
Cost/Pound (1 opr.)	$.263	$.254	$.329	$.312
Cost/Pound (½ opr.)	$.249	$.242	$.302	$.285

Now if the market price for these molded parts is $.33 per pound as molded, the daily margins in dollars from the above cost and pounds per press per day output are as follows:

TABLE D

60-Second Cycle

	4000 psi .855 lbs./heat		8000 psi .427 lbs./heat	
	70% eff.	90% eff.	70% eff.	90% eff.
Profit/day (1 opr.)	$45.70	$71.00	$10.80 loss	$ 2.77 loss
Profit/day (½ opr.)	$60.50	$88.70	$ 3.45	$14.95
50-Second Cycle				
Profit/day (1 opr.)	$69.20	$101.00	$ .52	$11.97
Profit/day (½ opr.)	$83.70	$117.00	$14.45	$29.95
Increased Profit From 10-Second Saving in Cycle Time				
1 operator/-press	$23.50	$30.00	$11.32	$14.74
½ operator/-press	$23.20	$28.30	$11.00	$15.00
Annual Profit Gain Per Press 175 Days From 10-Second Saving in				
Cycle Time	$4000.	$5000.	$1950	$2600
Cycle Time	$4000.	$5000.	$1950	$2600

If the press operates 70% of the time or 175 out of a possible 250 days per year, the increase in gross profit due to a consistent 10-second saving in cycle time is from $1950 to $5150. It is interesting to note that the carrying charges on $10,000 of equipment is only $1570 per year. This indicates the rewards for increasing the output of the molding press. This was done in three ways:

1. By increasing the size of the charge by reducing the unit pressure.
2. By increasing the efficiency of the operator from 70% to 90% by a piece-work incentive which raised his hourly pay from $1.15 to $1.48.
3. By increasing the output by reducing the standard cycle time from 60 seconds to 50 seconds by savings in press operating time and change time.

Having looked at this analysis of the general

anatomy of cost and gross margin, let us now go to our main theme and see how the design of the molding press affects it. The elements of molding costs are fundamentally controlled by:

1. Direct material utilization.
2. Operator time and effort expanded.
3. Press time expanded.

Let us examine these separately:

Direct Material Utilization is affected by:

a. **Waste** or the percent of the material loaded which is thrown away as flash, cull, runners, and vent bleed-off. The most efcient mold designs can be made where pressure of the molding press is adjustable; both on clamping and transfer rams independently. This allows for optimum ratio of pot area to parting line area, and tends to give greater parting line area, hence greater weight of parts per cycle.

b. **Spoilage** is the percent of molded parts rejected for defects. Press factors here are uniformity of cycle time, temperature, and pressure. Automatic cycle timers, controlling, pressing and cure time; push button and limit switch control of ram speed and pressure; and prompt and uniform automatic sequences in the press operating cycle all add uniformity to this cycle. Where the cycle is properly set and the work is checked for uniformity the spoilage can be minimized.

Direct operator time and effort depends on the general layout of the work space, the convenience

(Continued on Page 18)

"HY-JECTOR" PRESS DISCUSSED AT NEW YORK SECTION

By WILLIAM SCHACK

The peculiar advantages of the recently developed "Hy-Jector" molding press, as well as its limitations, were presented in a talk and motion pictures at the March meeting of the New York Section by W. B. Herbert, Cinrock Machinery, Inc., who substituted for the scheduled speaker, Earl Johnson, Rockford Machine Tool Co., manufacturers of the press.

William Schack

The "Hy-Jector" was described as a fully automatic molding press, though the casting must be removed by hand. Its outstanding features are that it incorporates both a preforming device and a unit to preheat the preforms so made by high frequency heating and the charge is forced into a closed die. Mr. Herbert pointed out that all the machine's operations are infinitely adjustable and that it effects several economies, due to its quick cycling, high productivity per cavity, the comparatively low pressure required (prolonging the life of the die), decreased material handling and saving of molding compound (since none of it is left in the mold after ejection).

The machine is not recommended for use with multi-cavity molds for very small parts (which would involve too much wastage of compound in the runners), for moldings with very thin sections, for multiple insert moldings (which require too much manual work between cycles), or for fiber-filled compounds.

The press was said to be ideally suited for processing general purpose phenolics and melamine compounds for parts with a cross-section of 1/8 inch or more and a weight that would make from two to 24 cavities possible within the capacity of the machine. Since the molding of urea products with preheated preforms has not been very successful, it is worth noting that Mr. Herbert reports that the "Hy-Jector" has "the speed, accuracy and pressure control necessary to mold urea successfully when the material suppliers eliminate the flow line problem."

The "Hy-Jector" models constructed so far, which are in use in several plants, are of 8-oz. capacity, Mr. Herbert said, but a 16-oz. has been designed and the first one is under construction, with larger capacity machines in the offing.

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Economics (Continued from Page 17)

of material and insert containers, press controls, etc. Let us list the various things the operator does in the operation of a transfer molding press and see what can be done to eliminate them or make them easier, more effective, or less time consuming.

Operation	Comments
a. Open press	Let cure cyle timer initiate automatic sequence which lets clamping pressure be released and mold open slowly as transfer ram ejects cull from pot and parts pull off the top portion of the mold. Then clamping ram retracts rapidly to beginning of knockout and then slows down as parts are lifted by knockout pins to avoid distortion. Transfer rams then automatically retracts. All this without need for operator attentilon.
b. Wait for mold to open	Operator does not need to be at the press while the mold opens if the sequence under (a) is automatic.
c. Remove parts from the mold: 1. By hand 2. By "fork" 3. By air jet	Press designed with proper height and proportions for easy access to mold. Work space provided to lay the parts for later inspection or place for tote box to hold parts removed by fork or by hand. Hopper and funnel on back of press to catch parts blown off by air jet.
d. Set parts on cooling or "shrink" fixtures	Convenient work space arrangement on front of press. Handy location of air hose with one-hand squeeze or press valve on nozzle. Counter weighted or spring to return to idle position—out of the way.
e. Clean mold with air jet	
f. Set inserts	Insert hopper in a convenient safe place on the work space; let down knockout pins by a hand or foot operated lever; sufficient mold opening and right height to reach all mold cavities or to place an insert loading fixture.
g. Close press	Automatic push button control; fast traverse; allow final close, adjustable to conserve time but avoid mold or insert damage.
h. Load compound	Convenient location of preheater for quick transport of heated pills to transfer pot; ample room to reach to opening of transfer pot.
i. Send transfer ram down	Push button control; fast traverse; ample hydraulic volume and pressure to transfer compound quickly and hold pressure.

The minimum operator time is the change time from the operator's approach to the press with the mold open until his departure from it as he presses the transfer ram push button.

Similarly the press time utilization can be studied:

a. **Cure time** depends on the temperature of the mold, temperature of the compound preheat, and the temperature pickup during the transfer time, and the characteristics of the compound. This cure time may be as low as 8 to 10 seconds under carefully set conditions and with a high temperature mold. It may be as high as 90 to 120 seconds. Longer cure times go with manual press control and slow speed presses because of difficulty of tuning the cycles up to uniformity needed for high preheat, high mold temperature, and short cures.

b. Press opening time, if manual, is added to the change time. If the press opening is done automatically, it does not require the presence of the operator. In any event, it is part of the cycle time. Automatic operation should consider things which help improve the spoilage situation such as slow break open of the mold, fast traverse and slow eject at the end of the opening stroke.

c. Waiting time may need to be included in order to balance out the cycles for the operator. Judging by the size of the elements of cost, and the value of getting high output, it is probably better to let the operator wait a little for the press than to have the press wait for the operator.

d. Change time as outlined above.

e. Transfer time, or the time it takes the transfer ram to come down and to force the preheated compound from the pot into the mold. The free travel of the transfer ram should be as rapid as possible, and the time to force the compound from the pot should be short compared to the minimum cure time if uniform molded parts are to be had.

The opportunities for saving in cycle time are only in (b) and (e) above as far as the press is concerned where (h) and (g) in the list of change operations are performed at the same time and time for press closing is less than the time for material transport from the preheater to the transfer pot.

Let us examine the effect of ram speed on press opening and transfer time. We will assume an 8" mold opening and a 10 to 15" transfer ram stroke

(8 to 12" free travel and 3" tranferring compound).

TABLE E

Press Ram Operating Times (seconds) on 150- and 200-ton Transfer Presses with Bottom Clamping Ram and Ton Transfer Ram.

	Closing	Opening	Transfer	
			Free Travel Moving Compd.	Retract
a.	3.74 sec.	4.0 sec.	2.5 (12")	5.6
b.	4.6	5.0	8.6 (7")	—
c.	3.5	4.0	3.8 (9")	11.1
d.	2.6	6.8	5.0 (7")	Free Travel
			4.0	
			4.0	
			4.0	
			5.6	

It will be noted that clamping ram closing time is less than 5 seconds in all cases which gives the operator plenty of time to get the pills at the preheater and transport them to the transfer pot; possibly even to reload the preheater for another press, so this it not press time added to the cycle.

The transfer ram retracting time will not add to the cycle unless it is greater than the time to remove parts from the mold and blow it clean. The shorter times indicated, around 5 to 6 seconds, should be amply short in most cases, although the longest time shown might interfere with easy changing jobs such as small molded parts which can be blown from the mold directly.

The mold opening time and the transfer ram free travel time add to the cycle time as does the compound transferring time where this is longer than that limited by the compound flow. In the examples tabulated, the press time in the cycle in which the press is the limiting factor ranges from a minimum of 6.5 seconds to a maximum of 13.6. This difference of a little over 7 seconds is quite significant, and as we have shown earlier in this paper can mean a very substantial dollar difference in profits over a year's time where short cycles are in operation.

Conclusion

We have tried to show the opportunities for cost reduction and profit making which are affected by the design and layout of the molding press and its auxiliaries. The illustration has been by example, large hypothetical, to indicate the pattern. In a particular case, the molder can get the facts and figures on pressing equipment which is available to him and compare what he is doing now with what he might do if he tried; either by improving the equipment he now has, or by replacing it with new. This can make a lot of difference as competition tightens; which may be sooner than we think.

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W.N.E. HEARS BAILEY ON THERMO EXTRUSION

By GEORGE W. MARTIN

The March meeting of the Western New England Section of the SPE was held at the Hotel Sheraton in Springfield on the 3rd.

The section president, Mr. Frank Donohue, called the meeting to order immediately following a very excellent dinner.

Mr. Donohue reported the committee chairmen appointed for the current year:

Professional Activieies: W. S. Larson, DeBell & Richardson; Membership: George Carlson, Arrow-Hart & Hegeman; Credentials: J. F. Hanson, Rogers Corporation; Program: H. M. Richardson, DeBell & Richardson; Publicity: George W. Martin, Noma Electric; Finance: Open; House: Open; Historical: Open; Education: Open; SPE News Reporter: George W. Martin, Noma Electric; SPE Personals Reporter: George W. Martin, Noma Electric.

After expressing his appreciation for the very fine attendance, Mr. Donohue introduced the speaker of the evening, Mr. James Bailey, Vice President and Research Director of Plax Corporation.

Mr. Bailey chose for his subject, "Extrusion of Thermo-Plastics."

In opening Mr. Bailey pointed out that extrusion is a composite phenomenon consisting of forcing plastic to flow against a more or less high back pressure and, at the same time, melting the compound and bringing it to a uniform condition of temperature and physical properties.

He explained that almost any remark would need to be changed if different plastics were used because of the fact that plastics consist of materials which may be hard and glass-like at room temperature, as is polystyrene, or more or less rubbery, as are some of the Geons and Vinyls.

Heating is accomplished both by heat applied to the extruder and as heat supplied in the form of mechanical work by the driving mechanism.

Following these remarks a series of slides giving the operating conditions which exist inside an extruder were shown. The effect of the change in elasticity of the material as it passes through the extruder upon the development of pressure was discussed. This was followed by a series of slides which show the output of an extruder based upon purely viscous flow, in which the output dropped as the pressure increased, and a slide of actual operating data which showed that for the harder plastics the output remained practically unchanged with pressure, whereas in soft plastics, such as polyethylene, the output dropped off as the pressure increased.

Die design was discussed and illustrated with a series of actual die shapes and the extrusion obtained from them. Some of the methods of correcting dies and the effect of viscous and plastic flow upon the shape of the extrusion were briefly discussed.

It was shown that the phenomenon of "puffing

(Continued on Page 20)

W. New England (Continued from Page 19)

up" makes it very difficult to produce thin and heavy sections close together in an extruded shape. Bubble trouble which is one of the difficulties of extrusion was briefly discussed and a series of typical examples shown.

Following this the effect of various forms of pulsation and vibration on the surface of extruded pieces was illustrated. The method whereby Plax extrudes Lubofilm rod and makes Polyflex sheet was illustrated as examples of the fact that handling the extrusion after it leaves the die is usually just as important as the actual extrusion process itself.

Optical effects produced by strain and orientation in polystyrene as seen in the polariscope were illustrated in kodachrome colors and some of the information obtained from the polariscope was discussed.

The talk was followed by a question period in which such matters as the heating effect due to friction and other matters in which the SPE members were particularly interested were discussed.

MOXNESS AT QUEBEC

By J. A. MAJOR

The Quebec Section of the Society of Plastics Engineers held its second meeting at the Montreal Technical School on March 15th.

A most interesting talk was delivered by Mr. Sven K. Moxness, chief process engineer of the Minneapolis Honeywell Regulator Company. His subject was the use of live steam preheating in the compression and transfer molding of thermosetting materials.

The speaker was presented by Mr. Wilfred H. Lynch, president of the section.

Much informative and up to date information was given by Mr. Moxness and the audience was especially pleased and impressed by the willingness and openness with which so many factual data were transmitted to them for their profitable use.

The emphasis of the necessity for engineers to communicate to one another their experience in the different fields of plastics was also stressed by one of the attendants, Mr. H. Cameron of the General Electric Co. who had come from New York for the occasion.

The lecturer was thanked by the advertising committee in the person of Clement Auger.

The secretary wishes to express his thanks to all present and to state that the next meeting will take place on April 19, at the Montreal Technical School, at 8 o'clock.

The speaker on this occasion will be Mr. Carl Holmes and his subject will be the designing of injection molds.

Mr. Holmes is one of the outstanding plastics engineers of today.

DETROIT ENGINEERS TURN THEIR KNOWLEDGE TO FOOTBALL SCIENCE

By PAUL B. LILLIS

Don F. Hoffman, Program Chairman, has kept his word to the members of the Detroit Section of the SPE. When Don took the position of Program Chairman he volunteered that he would offer a program that would interest not only the very technical engineers, but also those who were inclined toward the "lighter" things in life. On March 19, the late winter program was held at the Horace Rackham Memorial Building.

P. B. Lillis

After a fine dinner, the moving picture of the 1948 Bowl game was shown. This game was between the University of Michigan and the University of Southern California, Michigan, the victor, by a score of 49-0. A very fine commentary was given with the showing of the picture by Wally Weber, Freshman Coach of the University of Michigan.

Mr. Weber is well known in the Detroit area for his ability as an after-dinner speaker. Mr. Weber, while being the Freshman Coach, also does a great deal of the scouting for the University during the season. His duties carry him across the country several times a year and afford him many opportunities to address such groups as Rotarians, Kiwanis Clubs, and "Monday morning quarterback" meetings. The SPE was very fortunate in obtaining a man of Mr. Weber's erudition to comment on the film as it was being shown.

Through the assistance of Mr. Weber, many people who did not understand the finer points of a football contest were shown which action and what players to observe for a full appreciation of the execution of a play. I am sure that those who were interested in football and those who were not, felt as though they had learned something after the evening was completed.

LOU BARNETT, 1947 President of Eastern New England Section, is currently Vice President of the North Texas Section. Lou has established his own molding shop in Fort Worth as Loma Plastics, Incorporated.

DENTON PAPER ON PETROLEUM RESINS GIVEN AT PHILADELPHIA

By RICHARD B. BISHOP

A dinner was held in honor of the Philadelphia Section Prize Paper Contest winners at the Franklin Institute on February 17, 1948, after which they presented their papers before 50 members of the section.

W. I. Denton

William I. Denton, who won first prize ($50.00) for this paper entitled "Relation of Petroleum to the Resin Industry," is a graduate of Case School of Applied Science, obtaining a B.S. in engineering in 1938 and an M.S. in Chemistry in 1939. Mr. Denton has published a number of articles in the scientific journals on chemicals from petroleum and holds several U. S. patents in this field with numerous others pending. He is at present employed as a Senior Research Chemist by Socony-Vacuum Oil Company, Inc.

Mr. Denton's paper traced the production of numerous resins and plastics from petroleum products with emphasis on the production of basic chemical intermediates rather than on the production of finished resins. Some of the newer processes for the production of such chemicals as, phthalic anhydride, phenol, thiophene, benzonitrile, aromatic formalite resins catalyzed by hydrogen fluoride and oxygenated chemicals from the Synol process were discussed. This was a very interesting and informative talk, clearly indicating the value of petroleum to the resin industry.

The second prize ($25.00) was awarded to Mr. Thomas Rutledge also employed by Socony-Vacuum Research Laboratories, for his paper entitled "Silicone Polymers—A Brief Survey of Their Preparation, Properties and Uses."

Mr. Rutledge, a native of Tennessee, was graduated from the University of Arkansas (1943) with a B.S. in chemistry. His research career was interrupted by a two-year turn in the U. S. Navy and one year of graduate work at the University of Pennsylvania, but he is now back at othe Socony-Vacuum Laboratories.

His paper was a scholarly study of the literature of the silicones. His presentation and clearness of thought and expression made this paper outstanding. Though this was not a complete review of the field, it certainly gave the audience an excellent idea of the preparation and properties of these semi-organic polymers. Their numerous uses and applications and an appraisal of the product evaluation made the paper more valuable and pleasing.

The Philadelphia Section held their monthly meeting on March 16th at the Franklin Institute. The dinner which preceded the speakers was attended by 42 members and guests and was a gourmet's delight. By meeting time 55 members were in attendance to a program in which Mr. Islyn Thomas of the Thomas Mfg. Corp., and Mr. E. W. Spitzig of the Newark Die Corp. collaborated in a fined dual speech of "Hobbing, Its Possibilities and Limitations." Also on the program was a film supplied by U. S. Motors, Inc. titled "Rhapsody in Motion."

The success of the evening was indicated by the post gathering in the front of the hall. When the Institute closed at 10:30 p. m. these discussion groups moved to the Ben Franklin Hotel.

WILLIAM LESTER, of the Newark Section, president of Pyro Plastics Corp., announces a change of address of the company from 526 North Ave., East, Westfield, N. J. to 690 Chestnut St. at Route 29, Union, N. J. The new phone number is Unionville 2-7600.

WILBUR GUNNERSON, formerly with Yardley Plastics, is now with Marsh Plastics in Cleveland.

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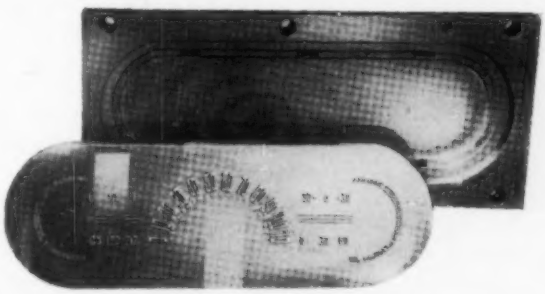

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PERSONALITIES

EVERETT E. ECKENBECK is now with Midwest Plastic Products Co. at 1801 Chicago Road Chicago Heights, Ill.

HERBERT L. MERIN is now associated with the De Luxe Game Corp., 200 Fifth Ave., New York. He was formerly with Ideal Plastics.

W. HOWARD STAGG, formerly of Beacon Products Corporation, who was with us for part of 1947 has established an office at 1321-25 Tioga Street, Philadelphia, as plastics consultant and sample molding.

NICK RAKAS, formerly of Fisher Plastics Corporation, is now head of research and development of plastics and synthetic textiles for National Automotive Fibres, Inc., 19925 Hoover Avenue, Detroit, Michigan.

We wish to welcome to our midst Mr. GUSTAVUS J. ESSELEN, President of Gustavus J. Esselen, Inc., Chemical Engineers of Boston. Mr. Esselen has transferred to us from the Detroit Section. We shall be looking forward to seeing him at our meetings.

NEW ORLEANS DISCUSSES DEVELOPMENT OF PLASTICS INDUSTRY IN THE SOUTH

By PAUL F. OSWALD

The New Orleans Section meeting was held in Room H, Roosevelt Hotel. Opened at 8:30 p. m. by Mr. Ralph Chambers, Vice-President. Mr. Chambers introduced the visitors and members to one another, after which the minutes were read and accepted as read by motion of Mr. Levey, and seconded by Mr. Gore.

Mr. Chambers made a short address setting forth and reiterating the aims of this Section of SPE. A film "Development of plasticts industry" was shown.

After the film there was a short discussion of vinyl impregnated glass fibre.

Mr. H. A. Levey, the speaker of the evening, was introduced by Mr. Chambers.

Mr. Levey spoke on "Development of Plastics Industry in the South." The main points of his speech:

1. Availability of raw material, cellulose, cotton, wood, ramie, sulphur, petroleum, salt, natural gas and coal.

2. Labor; favorable climatic conditions of year and less migratory.

3. Geographic position for local market and export.

4. Situation ideal for the commercial molding, fabricating and marketing.

The question was asked by Dave Stuart "How do you feel about the lack of sales organization in this area as regards plastics?" Answered by H. A. Levey, "We have the sales organization. All we need to do is further the education and the development of the local organizations in plastics."

The first Thursday of each month was designated as local meeting nights. The meeting adjourned at approximately 11:15 p. m.

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Coumarone - Indene *(Continued from Page 1)*

tion of the increased reactivity of indenes over coumarones is found in their structures. Indene is the benzo derivative of cyclopentadiene. The benzene nucleus has no bonds available for polymerization due to resonance stabilization. In cyclopentadiene there is only slight resonance stabilization and the olefinic bonds are quite capable of undergoing polymerization. It is true that in the condensed molecule, benzocyclopentadiene (indene), there is resonance of the benzene nucleus with the cyclopentadiene ring but it is relatively neglible; therefore, the olefinic bond of indene can resinify with ease. The fact that cyclopantadiene polymerizes more readily than indene is due to a combination of steric factors and also the slight resonance stabilization of the cyclopentadiene ring in indene. On the other hand, the coumarone molecule can be considered as made up of the candensed rings of benzene and furan. Both of these molecules exhibit aromatic character; in fact Gilman [2] considers furan even more aromatic than benzene. There is very little available data on polymers of furan and because of the high resonance energy of the furan nucleus, one would expect that they would form only with difficulty. It is known that there is considerable resonance of the benzene ring with the furan ring in coumarone and the resonance energy of coumarone exceeds that of indene by a large amount. For this reason it is particularly surprising how easily earlier investigators obtained polycoumarone. However, the experimental proof of polycoumarone resin obtained by Kraemer and Spilker justifies to some extent the common belief that commercial coumarone resins contain polycoumarone. These investigators obtained their polymer by the action of sulfuric acid catalyst of a concentrated solution of pure coumarone in benzene. Much of the earlier work is rendered somewhat uncertain by the fact that

investigators used impure coumarone as the starting material.

It is not the purpose of this review to refute any manufacturer's claim that his resin contains polycoumarone or polyindene. This review has merely detailed those factors which adversely affect the polymerization of coumarone. Briefly, again these factors are:

1. There is a loss of a great deal of the double bond character in the oxide ring because of resonance. This high stability of the oxide ring is evidenced by the resistance of coumarone to boiling acid and boiling alkali. Also monomeric coumarone remains essentially unchanged when is is passed through a red-hot tube.
2. Indene resinifies much more readily than coumarone. In a solution of the two in a common solvent the indene would polymerize more rapidly and spend the catalyst to such a degree that it might be insufficiently active to polymerize coumarone.
3. The polycoumarone polymers obtained experimentally were from relatively concentrated solutions. In a 165-185°C fraction of naptha the coumarone is present in a relatively low concentration. In solution polymerization we know that the more dilute the solution the lower the molecular weight of the polymer obtained.

Table I

Resinous Producing Substances in Coal Tar Naphthas

Compound	B.P. °C	Source
Indene	181-2	Fraction 176-182
Coumarone	173	Fraction 168-175
Styrene	145-6	Fraction below 150
Alkyl Styrenes	Vary	Fraction 150-200
Cyclopentadiene	41-2	Fraction below 150
Dicyclopentadiene	170	Fraction 168-175
Methyl Indene	204	Fraction 200-210
Dimethyl Indenes	Vary	Fraction 220-235
Methyl Coumarone	192	Fraction 185-200
Dimethyl Coumarones	Vary	Fraction 215-225

It is significant that the present tendency is to call coumarone indene resins polyindene resins rather than coumarone resins as in the past.

Commercial resins have an average molecular weight of 800 with a degree of polymerization of about 6 to 7. The higher the degree of polymerization, the greater is the melting point of the resin. Commercial polymers of this type range from viscous liquids to solids melting at 150-160°C. The polyindene molecule, irrespective of molecular weight, combines with two atoms of bromine and therefore each polymer contains an olefin linkage.

Because of the presence of a double bond in the end group of their relatively low molecular weight molecules, these resins possess an appreciable amount of unsaturation. Iodine numbers run from 15 to 60, with account being taken of sub-

(Continued on Page 24)

Mexico

(Continued from Page 3)

They are as follows: Mr. John H. Field Jr. President; Sr. Jorge Lopez, Vice President; Sr. Jorge Martinez, Treasurer; Sr. Raphael Quijano, Secretary. Mr. William B. May Jr. will remain as Program Chairman and the board of directors includes: Mr. John H. Field Jr., Mr. Fermin Fulda Jr., Sr. Jorge Lopez, Sr. Ernesto Del Valle and Mr. J. H. Daniell.

Any member of the SPE who is planning a visit to Mexico and is interested in attending one of our meetings while here, is most cordially invited to do so. He may contact this reporter by mail or telephone at Plastipos, S. A., Apartado 81-BIS, Mexico, D. F.

Durez Sells West Direct

A. W. HAMMER, Jr., Vice President of Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. announces that the agency agreement existing between that company and C. D. LaMoree of Los Angeles, California has been terminated as of April 30 1948.

Effective May 1, Durez Plastics & Chemicals, Inc. will sell its phenolic molding compounds on the West Coast direct to the user as it does in all other sections of the country. EVAN E. GRAHAM, who has been in the employ of the company for the past eight years, is the sales engineer assigned to the territory. Mr. Graham will shortly establish headquarters in Los Angeles.

Coumarone - Indene (Continued from Page 23)

stitution during determination. It is thought that that reason for the gradual characteristic discoloration of coumarone indene resins is due to the oxidation of this terminal unsaturated linkage. H. Staudinger and collaborators [4] polymerized chemically pure indene with a catalyst such as stannic chloride in benezene solution and were able to isolate hemicolloidal polyindenes with polymerization degrees of 14-52. These polymers were white powders with molecular weights of 2000-5000. It is noted that these molecular weights are considerably higher than those obtained commercially. This is undoubtedly because the indene is present in higher concentrations in the solutions which Staudinger investigated than in those natural solutions in coal tar naphtha. It is interesting that viscosities of solutions of indene and styrene are similar in magnitude and indicate similar molecular structure in the two polymers. However polyindenes, unlike polystyrenes, do not undergo ozonolysis and the product is a mixture of polymerized monoxide and dioxide. No polyindenes have been known to show crystalline structure under X-ray examination but it is a question of whether this indicates an amorphous polymer or merely that incorrect means of fractionation of the test sample were employed.

The industrial preparation of coumarone indene resins is briefly as follows. For a high grade resin a 165-185°C boiling naphtha is washed with a very small quantity of concentrated sulfuric acid so as to remove all materials such as tar bases, cyclopentadienes, alkylated styrenes, etc., which adversly affect the color of the resin. The purified naphtha is then treated with a catalyst such as concentrated sulfuric acid or stannic chloride at relatively low temperatures (circa 10°C) to complete resinification. Finally, the spent acid is neutralized and the volatile constituents of the unreacted dead oil are steam distilled. Any unreacted coumarone would also be distilled off at this point. The resulting product is a complex mixture, hemicolloidal in nature.

In Table I, there are a number of more common resinous producing substances that exist in coal tar naptha. Depending on the broadness of the naphtha cut employed to produce the resin, one or all of these materials may exist together in the resulting polymeric mass. The presence of styrene, cyclopentadiene and dicyclopentadiene darkens the color of the coumarone resin and consequently cheapens it to a great extent. The lower grade coumarone indene resins contain relatively high percentages of the polymers of styrene, styrene homologs and dicyclopentadiene. Some of these cheaper resins are produced by neutralizing the preliminary wash used to clean up a naphtha preparatory to the manufacture of a high grade resin, leaching the salt, and then completing the resinification to the desired state by heat. The resulting products are brown to black as compared to the bright straw color of the high grade resins.

The alkylated and dialkylated indenes and coumarones occur in the naphtha which has a boiling range of 185-220°C but their concentration is slight. It has already been mentioned that dimethylcoumarone does not polymerize. All three isomeric monomethyl indenes resinify to complex solid insoluble polymers and dimethyl indene has been found to form a sticky polymer. Methyl coumarone goes to a syrupy mass. These alkyl substituted polymers are to be avoided chiefly because they polymerize with more difficulty and hence would lower the average molecular weight of the coumarone indene resins. Furthermore, a naphtha fraction boiling between 165 and 220°C, which would contain indene and coumarone and their lower alkylates, represent a relatively dilute solution and hence lessens the possibility of producing high molecular weight polymers from even the more reactive monomeric constituents.

It was mentioned earlier that coumarone indene resins underwent a characteristic gradual discoloration. An explanation of this can be found in the structure which shows a terminal double bond. According to Wakeman [5] this coloration is traceable to "combined oxidation of the double bond and fulvenation of the methylene group of the ultimate cyclopentadiene group." In order to produce a resin with color stability, The Neville Company hydrogenate high grade indene resins to an average iodine number of 20-30. These saturated resins

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Ask for Bulletin K-200 which is a brief picture story of how Imperial Molded operates. Also Bulletin K-100 showing stock pulls, knobs and handles.

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are clear water white and are quite stable to atmospheric oxidation. As would be expected, this increases the hydrocarbon nature of the resin but in general, with the exceptions noted, its properties are quite similar to the parent material.

The last important variations of coumarone indene resins are those materials which are called modified coumarone indene resins. Two commercially important modifications are coumarone indene-tar acid condensate and the coumarone indene-tar acid mixture. In the preparation of the former the tar acids such as phenol, cresols or xylenole are mixed with the desired naphtha fraction and polymerization conducted by convential means. During the resinification the tar acid condenses or, perhaps better, adds across the olefinic bond of the indene. As would be anticipated, this reduces the tendency to polymerize and consequently the molecular weight and melting point of these resins are correspondingly lower.

The reason for conducting such a condensation is to improve the alcohol solubility of the resin and to make it more compatible with various commercial synthetic resin base paints and lacquers. The mechanical mixture of tar acids and coumarone indene resins is manufactured for the same purpose.

This concludes the resume of the chemical nature of the commercially important coumarone indene resins. Considerable research is being conducted on these materials and it is not unlikely that manufacturers in the future will make available coumarone indene resin molecules that are tailor-made for specific industrial requirements.

Application of Coumarone Indene Resins and Correlation of Their Chemical Nature with Physical Properties

Coumarone indene resins are marketed in a wide range of melting points varying from viscous liquids to brittle solids melting around 150°C. The higher the molecular weight, the harder and higher melting is the resin. The low melting resins are either high polymers cut back with the proper amount of oil or simply low polymers. The colors range from colorless clear for hydrogenated polyindene to almost black for a resinified cyclopentadiene - styrene - indene conglomerate. All are thermoplastic in view of the fact that they linear polymers; however even after they are completely fused, the higher melting grades (essentially polyindene) do not undergo extensive decomposition until temperatures in excess of 300°C are reached. All types of these resins are hydrocarbon in nature and for this reason are resistant to the action of most inorganic chemicals. Concentrated acids darken and decompose them but alkali and dilute acids have practically no effect. Although the resins are not water or alcohol soluble, they exhibit ready solubility in nearly all aromatic and chlorinated solvents and the important fatty oils with the exception of castor oil. They are at least partially compatible with commercial polymers, a notable exception being the cellulosic esters.

Coumarone indene resins have no commercial application when used alone. They are brittle and have no impact or tensile strength. For these reasons they are always employed in a secondary role such as that of plasticizer, softener, extender, binder, diluent or other modifier. This is not unusual if one remembers that these are extremely low molecular weight compounds compared to those polymers that are used industrially as plastics and rubbers. It is not unlikely that if we were able to prepare a polyindene with a degree of polymerization of 75-100, we would have a therrmoplastic which could serve as the principle resin in several types of recipes. One could go further and predict excellent heat resistance and electrical properties for such a polyindene inasmuch as the present commercial low polymers already excel in these properties.

Nearly ninety percent of the approximately 35,000,000 pounds of all types of these resins annually available are used in the floor tile and rubber industry. The remainder finds its way into varnishes and coatings, molded products, printing inks, paper compositions, chewing gums and adhesives. Up until the time of the war by far the

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"1000 PIECES AN HOUR" HANTZ AT N. W. PENN.

By J. A. LORANGER

Mr. B. F. Hantz, Chief Engineer of the American Insulator Corporation, New Freedom, Pennsylvania, was guest speaker at the Northwestern Pennsylvania Section meeting held February 11, 1948 at the Uthman Chor Club, Erie, Pennsylvania. Mr. Hantz outlined in brief the history of cold molding plastics which dates back 40 years, and was introduced into this country by Mr. E. Henning. He indicated that the prominence of these materials is due largely to their heat and arc resistance and economical production. It was also pointed out how small and medium size runs can be taken care of with minimum tool expense, often with one single cavity mold.

Mr. Hantz supplemented his talk with slides showing various molding operations of the American Insulator Corporation Cold Molding Plant. He pointed out that this work is done at 2,000 to 4,000 psi without heat and at rates as much as 1,000 pieces per hour from a single cavity, and often with inserts included, followed by conventional oven baking. Graphs showing the physical and electrical properties of various compositions were shown and fully discussed with the members. Mr. Hantz outlined various applications for cold molding such as valve handles, switch bases and plugs· connector plugs, switch parts, et cetra, and illustrated all of these with actual moldings.

The appeal of Mr. Hantz's talk to the members was vividly illustrated by the lively question period which followed.

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greatest percentage of the resin was consumed by the floor tile industry but due to the excellence of these materials as compounding ingredients for synthetic rubbers, the rubber industry in the last few years has been demanding a much higher percentage.

The use of coumarone indene resins in floor tiling is certainly not because of their chemical nature or physical properties. Almost any light colored resin would be satisfactory but it happens that there are very few such materials in the same price range as coumarone indene resin. It is not the resin base but the coloring agent which is the most expensive ingredient of mastic floor tile. The alkali resistance of these resins is important however because the tile is often subjected to alkaline cleansers and alkaline waters in subgrade installations. The Barrett Division produces a resin known as "Cumar T" which they recommend for use in mastic floor tiling. "Cumar" is the trade name for Barrett coumarone indene type resins. The Neville Company and Pennsylvania Industrial Chemical Company also market coumarone indene resins but their available trade pamphlets do not recommend any specific type for tile. Neville resins are known as "Neville R and G" resins, "Paradene," "Nevillac" or "Nevillites"; those of the Pennsylvania Industrial Chemical Company are called "Picco" resins. Undoubtedly, of the Neville resins only the Neville R and G resins are suitable for floor tiling inasmuch as those materials represent their straight coumarone indene resins. It is quite apparent that the application of coumarone indene resins to the industry is more the application of an art than a science.

It it advantageous at this point to discuss in brief the minor applications of coumarone indene resins. Again their application is due not to any chemical or physical characteristics of the resins but chiefly because of their low price. Polyindene reduces the tendency of varnishes to gelatinize on standing and are also valuable as a resin for checking a batch at maximum temperatures. Also the coumarone indene resins that are modified either chemically or physically with tar acids represent resins which are extremely compatible and readily adaptable to alkyd and phenoli protective coatings. The resins are used in printing inks not only because of their neutrality and alkali resistance but also because of the high gloss they impart to the dried inks. In the manufacture of paper board these resins serve as waterproofing and stiffening agents. Both solution and thermoplastic adhesives are available from coumarone indene resins. In all of these minor applications the use of a high grade coumarone indene gives a high grade product and the use of the lower grade resins result in an inferior product.

Coumarone Indene Resins in GR-S Synthetic Rubber

It is in the synthetic industry that coumarone indene desins have enjoyed their most recent success but again one hesitates to attribute this success to the peculiar chemical nature or physical character of the resins themselves. They serve as excellent plasticizers for GR-S channel black compounds and as extenders and plasticizers for GR-S non black compounds. In the case of the latter type stocks, it has been found that the use of a high melting, high grade coumarone indene resin such as "Cumar MH" will improve the tensile properties of the stock by nearly 100%. There is also a simultaneous, much greater increase in the property of breaking elongation. For example, a fast curing stock highly loaded with a precipitated calcium carbonate filler has a tensile strength of 900 pounds per square inch and an elongation of about 350%. However, the same stock when compounded with about twenty per-cent resin has a tensile strength of nearly 1900 pounds per square inch and an elongation of 900%. In an attempt to analyze this outstanding phenomenon, several theories were offered, some of which suggested chemical interaction between

CENTRAL OHIO TO VISIT NEW COLUMBUS PLASTICS

By W. F. YOST

The March meeting of the Central Ohio Section SPE was held March 11 at Mounbuilders Country Club, Newark, Ohio.

Thirty-seven members and guests enjoyed a varied and interesting program.

Mr. W. Pederson of Dow-Corning presented an informative discussion on the subject of silicones.

Section Fast President Jack Knight of the Fabri-Form Company of Byesville also presented a condensed digest of the material on fabricating technique which he prepared for the National Conference.

Three door prizes, contributed by Yardley Plastics were awarded.

The April Meeting will be a plant visitation with Columbus Plastic Products acting as host to the Section. This is in the nature of an introduction to the Society of the new plant recently constructed by that company.

GOLDEN GATE SECTION MEETS

By JOHN G. ROBB

Fifty-eight members and friends of The Golden Gate Section met at the Lucca resaurant on February 17th to hear an address on "Patents" by Mr. Baldwin Vale, well known San Francisco patenting inventions and interspersed numerous instructive talk on problems associated with pattenting inventions and interspersed numerous stories of "screw ball" inventions.

After the speaker, the "Tenite" movie was shown by Mr. Lew West of Wilson & George Meyer Co. local Tenite agents.

Mr. Mike Gerow of the Newark section gave a brief summary of the plans of the National Professional Activities Committee, of which he is Chairman.

the resin molecule and the elastomer, presumably during vulcanization. These theories seem untenable because the resin can be quantitatively extracted unchanged from the vulcanized stock. Therefore this can only be a physical phenomenon.

There are data which show the increase in physical properties of the rubber vulcanizates to be dependent both on the particle size of the filler in the compound as well as the melting point of the coumarone indene resin involved. Table II below shows an approximate percentage increase in tensile properties observed with comparable GR-S vulcanizated prepared containing "Cumar MH" and the indicated fillers.

Table II

Various Fillers with Cumar MH in GR-S

Filler	Order of Decreasing Particle Size	Approximate Percent Increase
Water Ground Calcium Carbonate	1	0-10
Zinc Oxide (coarse)	2	10-20
Soft Clay	3	20-30
Zinc Oxide		
Red Iron Oxide		
Titanium Dioxide		
Precipitate Calcium Carbonate	4	100
Extra Fine Zinc Oxide	5	60-80
Precipitated Calcium Silicate	6	20-30
Thermal Carbons	7	0-10
Channel Carbon	8	0-(10)

In order to illustrate the effect of the melting point of the coumarone indene resin on the improvement in tensile properties, average data are summarized below which correlate the tensile strength of a precipitated calcium carbonate filled stock with the melting point of the resin which it contains as an extender. Such data are in Table III.

Table III

Effect of Melting Point of Coumarone Indene Resins on Increase in Tensile Strength of a Typical GR-S Carbonate Filled Stock

Resin Melting Point	Percent Increase in Tensile Approximate
25*	0- 10
50	20- 30
80	60- 70
110	100
125	100-105
150	100-105

*Not 100% polymer but a cutback of a high melting polymer with an oil.

There is therefore quite positive proof of the existence of this tensile improving phenomenon in GR-S non black compounds. As was said before, we know it must be a physical contribution rather than the result of any chemical interactions. It is particularly significant that coumarone idene resins do not improve the tensile strength of similar natural rubber and Butyl rubber compounds. One could suggest that coumarone indene resins behave somewhat as a dispersing agent and carry the filler into the interstices of the polymer where it can exert its maximum reenforcing effect. The largest particle size fillers are simply too large to be dispersible and hence no improvement of tensile properties would be observed when resin was added. For the extremely fine particle size fillers no dispersing agent is necessary to secure their penetration into the polymer micelles and hence the added resin would not improve the properties. GR-S is a heteropolymer which means that it possesses a disordered arrangement of its micelles. This micellular structure of GR-S is a much more disordered arrangement than exists in the essentially homopolymers, Butyl rubber and natural rubber. Therefore it requires some sort of agent to aid the filler into the interstices of GR-S but such should not be the case with either of the above homopolymers. Perhaps the hydrocarbon nature of coumarone indene resin is such that it is capable of distorting the micellular structure of GR-S so as to permit the filler particle into the interstices. If this were the case, we would expect other hydrocarbon resins to have similar action and thus behave as extenders and increase the tensile properties of GR-S. We know this to be true because certain petroleum derived resins behave almost as do coumarone indene resins. In fact it appears that any high melting resin, regardless of its source, which will increase the plasticity of unvulcanized GR-S will produce the phenomenon of tensile increase. Any resin which acts as a plasticizer must be a very short linear chain or its molecular radius must be sufficiently small so that the molecule will not behave as a fiber or a particle and and as a result stiffen the rubber stock. Possibly it is this reason why rosins stiffen GR-S compounds and have no effect in increasing their tensile strength. It is known also that the lower grade coumarone indene resins such as "Cumar EX" and "Paradene" stiffen GR-S and a possible explanation for this is that these materials are thought to be made up essentially of styrene and cyclopentadiene cross linked into a relatively bulky but low molecular weight molecule. Because of their low molecular weight these lower grade resinous materials are still thermoplastic and also improve tensile properties to a slight degree.

This concludes the proposed theoretical explanation of the charactersitic tensile promoting properties of some resins when used in GR-S non black compounds. The theory is original and, as the case with most theories, there are doubtless some flaws. However, in the development and proof of the theory it has been indicated what coumarone indene polymers the rubber chemist must use if he wants a soft high tensile GR-S compound and what type of coumarone resin he must employ if he wishes a hard stiff compound.

Summary

The review attempted to clarify the chemical nature of the various coumarone indene resins and, while doing this, it was felt necessary to

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include pertinent, original remarks on the doubtful presence of polycoumarone in such materials. In regard to the relationship between chemical structure and application, it was emphasized that the resins are frequently used for no reason other than their low price. Because of the great current interest in the use of these resins in GR-S synthetic rubber, their behavior when compounded into the rubber was discussed in detail and a theory of their characteristic behavior in non black GR-S vulcanization was offered.

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Detroit Exhibit (Continued from Page 3)

entire engineering profession of Detroit. We sincerely hope you will decide to attend.

Just sign the accompanying invitation and return it in the enclosed, addressed envelope to Mr. H. J. McGowan, and your complimentary ticket will be mailed to you.

Cordially yours,
DON F. HOFFMAN,
Program Chairman.

CLEVELAND HEARS DAWSON ON PERICAST MOLDS

By PHYLLIS SLOAN

The Cleveland Section Dinner Meeting was held at Brown's Cottage on Friday, March 26.

The Coffee Speaker was Dr. C. F. Prutton, head of the department of Chemical Engineering at Case Institute of Technology. Dr. Prutton spoke about the problems involved in educating men for the Plastics industry. In an industry as young as plastics, information becomes obsolete with each new graduating class. Dr. Prutton feels that the best way to prepare a man for a developing industry is to teach him how to think, how to attack a problem, and to have the courage of his convictions.

Mr. Charles E. Dawson of Dawson Associates, Leominster, Massachusetts was the main speaker of the evening. He spoke about centrifugally cast stainless steel for die cavities. He emphasized the fact that the demand for molds that really stand up is increasing. He spoke about the experience his company has had with Pericasting molds for the Toy and Novelty fields where high production jobs give a lot of abuse to the molds. Mr. Dawson feels that this is the most efficient mold for this purpose.

In Pericasting molds they work from approved models that are slightly over size to allow for shrinkage. The model is reproduced accurately and the detail is excellent. The cavities are polished, mitered and fitted. This cuts down the dimensions considerably and permits a smaller mold. The cavities are not brought to a high optical finish; they found that the abrasiveness of the material finishes them. Their method of toughening is adding chrome-tough alloy to Pericasting. With this toughening there are no shiny spots or wearing away at the parting line, longer life of the mold, and improved finishing qualities.

India (Continued from Page 7)

to serve American plastics materials, chemicals or machinery manufacturing company which may have, or wish to have, a business relation with India, as a salesman or technical adviser, or any such related job in India. Also interested in investing money for agency in India. Will undergo training in corporation if necessary from June to December 1948.

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Second Annual

S.P.E. Prize Paper Contest

Papers should be submitted to the nearest local S. P. E. Section president, not later than midnight Nov. 15, 1948.

Subject: The paper should be of general interest to the plastics industry and not previously published. Materials – their manufacture, chemistry, properties; Molding – technique compression, injection, cold molding, etc., product design, machine and mold design, special plastics and their uses; these are only a few of the possible topics.

Length: Papers may not exceed 5000 words.

Who is Eligible? ANYONE. There are no restrictions as to age or SPE Membership.

Prizes: Local Sections will pick winners among papers submitted to that Section and will award local prizes. Local prize papers will be judged in the National Contest by well-known judges. National Awards: $200, $100, $50 for first, second, and third.

The SPE reserves publication rights to all local prize winning papers until June 30, 1949.

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